REMR Technical Note OM-CI-1.2
(Supersedes OM-CI-1.2 1991)

The REMR Condition Index: Condition Assessment for Maintenance Management of Civil Works Facilities

Purpose

This technical note describes a system for quantitatively rating the condition of civil works facilities.

Background

To assist those involved in planning and budgeting for maintenance and repair (M&R) of civil works facilities and equipment, several REMR Management Systems are under development (see REMR Technical Note OM-MS-1.1). These computerized maintenance management systems should provide improved and more consistent methods for life-cycle cost comparisons of M&R alternatives and a more effective means for monitoring the condition of facilities.

The heart of these systems is the condition index (CI), a numerical indicator of facility condition and function level. By providing a quantitative and consistent means for describing the condition, the CI allows the conditions of facilities to be compared and monitored over time. With sufficient data collected, predictions about future conditions of facilities can be made.

The REMR CI Scale

The REMR CI scale, as shown in Figure 1, extends from 0 to 100, with 0 indicating complete failure and 100 indicating perfect condition and function.

The scale is divided into three "action" zones. In Zone 1 (70 to 100) condition and function are generally at a level at which only routine maintenance is required, while in Zone 3 (0 to 39) condition or function is usually poor enough to warrant immediate attention. Facilities falling in Zone 2 (40 to 69) show moderate condition or function deficiencies. It is within this "warning" or transition zone that the greatest potential for maintenance and rehabilitation planning typically exists.

Within each zone are either two or three condition levels. A brief description of the general condition and function for these levels is included.

REMR Condition Index Scale

Zone	Condition Index	Condition Description	Recommended Action
1	85 to 100	**Excellent**: No noticeable defects. Some aging or wear may be visible.	Immediate action is not required.
	70 to 84	**Good**: Only minor deterioration or defects are evident.	
2	55 to 69	**Fair**: Some deterioration or defects are evident, but function is not significantly affected.	Economic analysis of repair alternatives is recommended to determine appropriate action.
	40 to 54	**Marginal**: Moderate deterioration. Function is still adequate.	
3	25 to 39	**Poor**: Serious deterioration in at least some portions of the structure. Function is inadequate.	Detailed evaluation is required to determine the need for repair, rehabilitation, or reconstruction. Safety evaluation is recommended.
	10 to 24	**Very Poor**: Extensive deterioration. Barely functional.	
	0 to 9	**Failed**: No longer functions. General failure or complete failure of a major structural component.	

Figure 1. REMR CI scale

The REMR CI scale can be used as a standard language for describing the general condition of a facility. In addition, the use of numerical condition indicators allows for convenient data storage and handling by computer. It also allows condition indicators to be included in mathematical expressions.

The Condition Rating Process

Figure 2 illustrates the general process for determining the CI for a facility. This is typically a "pyramid" process, working up from the bottom. First, CI values are determined for subcomponents or other aspects of the facility. Through the rules and formulas established, these subcomponent ratings are combined to produce a rating for each major component. These, in turn, combine to produce a CI for the whole facility (or piece of equipment). While the REMR CI scale is used for all facilities and equipment covered by the REMR Management Systems, the specific procedure for determining the CI is different for each facility. Likewise, the level of detail contained in the rating process and the number and type of items rated are dictated by the requirements for managing each type of facility.

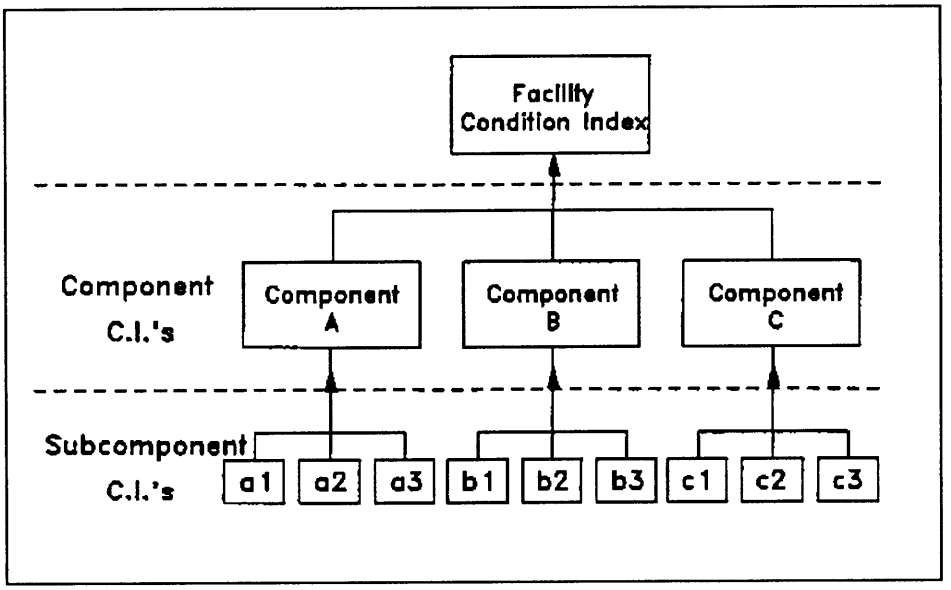

Figure 2. General structure of the CI process

The CI procedures are developed with assistance from representatives from the Corps Districts and Divisions who work with, and are responsible for, the particular type of facility covered by that REMR Management System. The procedures are field tested for reliability and repeatability before being adopted.

CI ratings may be produced from any measurements or observations which can be directly related to the physical condition and performance (function) of the facility - as long as these measurements and observations are repeatable, can be made consistently over time, and are acceptable to those who manage the facilities.

Application of the CI Ratings

The usefulness of these standardized numerical condition indicators becomes apparent in their application. Because they are produced in a consistent and repeatable manner, CI ratings permit the condition of different facilities to be compared and tracked over time. A CI-versus-time curve for a facility can be plotted as shown in Figure 3 if enough CI data have been gathered for the facility over time.

In combination with other information, these indicators and CI-versus-time curves can also be used for the following:

a. To establish goals for minimum allowable condition levels for facilities (and their components).

b. To compare the benefits of different maintenance policies.

c. To determine the most cost-effective time to perform the maintenance.

d. To determine the effect of repeated maintenance as compared to a single major rehabilitation.

An example application for comparing the benefits of different maintenance policies is illustrated in Figure 3. The left portion of this graph tracks a facility's condition from its brand new state (CI of 100) to the example current year (Year 44), when the CI is about 60. For this facility, a floor of 50 was selected as a minimum acceptable condition level. Projections indicate the condition will reach this floor within the next 3 to 4 years, thus requiring the facility to be rehabilitated.

In this case, plans call for two rehabilitation alternatives, shown in Figure 3 as Policy 1 and Policy 2. With Policy 1, the graph indicates the facility would be rehabilitated to a CI of about 90, would hold a high CI for about 10 years, and then would fall back to the minimum CI of 50 within another 20 years. Under Policy 2, the facility would be rehabilitated to a CI of about 75 and fall to the floor of 50 in 14 years, at which time the same rehabilitation measures would be repeated.

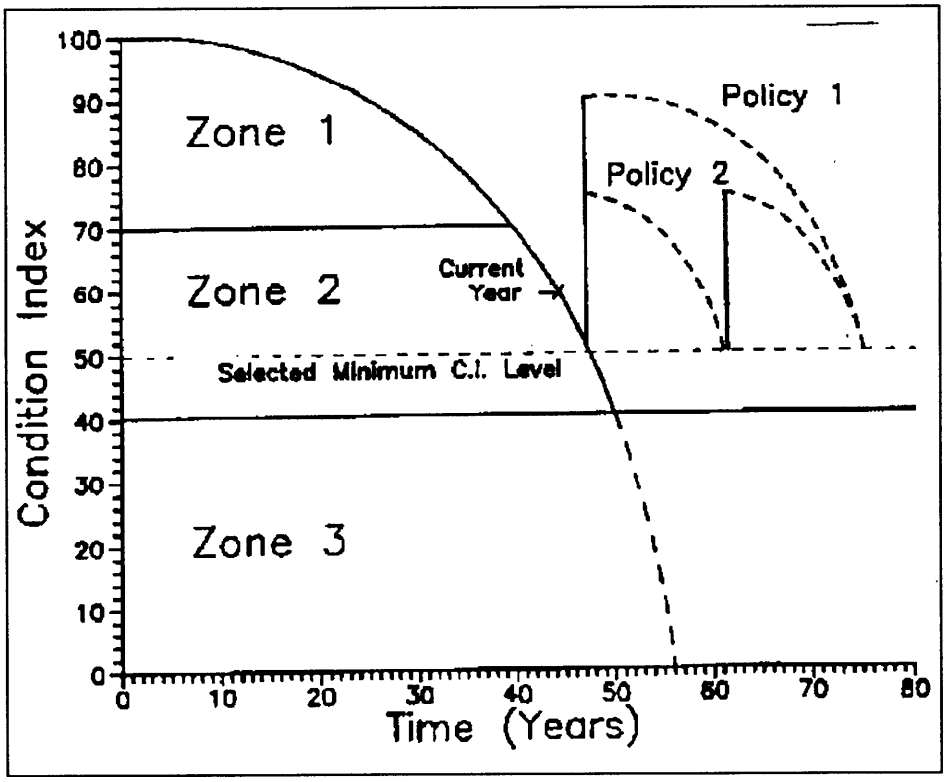

Figure 3. Example application for comparing different maintenance policies

In evaluating the two policies, the gain in CI for each would be compared against the cost for achieving that gain. In addition, the estimated condition for each year in the expected life of the rehabilitation would be considered. The evaluation might also address such questions as:

a. Is it necessary to raise the condition of the facility up to 90 (Policy 1), and likewise, it a CI of 75 high enough (Policy 2)?

b. Is it likely that funds will be available when needed to repeat the rehabilitation in 14 years, as required under Policy 2?

c. What is the likelihood of the CI dropping only 5 points during the first 14 years under Policy 1?

In summary, the REMR CI Scale and rating procedures permit the condition of a facility to be handled quantitatively for budgeting and work scheduling.